

A survey on knowledge of CBCT in dentistry among under graduate dental students.

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ABSTRACT:

Background: Cone-beam computed tomography (CBCT) is an advanced technology, in which conical beam is used in conventional computed CT. In CBCT, volumetric data are collected by the rotation of beams and detectors around the area of interest. The principal aids of CBCT are in the smaller footprint of the machine and lower radiation dose. The knowledge of this imaging modality is limited and hence the utilization in clinical practice is not fully attained.

Aim: The current study aims to assess the knowledge on Cone Beam Computed Tomography (CBCT) among undergraduate dental students of Saveetha Dental college and hospitals in Chennai and their willingness to use CBCT in their future dental practice.

Material and Methods: A self structured questionnaire was formed and sent to the undergraduate students of Saveetha Dental college. The data collected were analysed using SPSS Software. Comparison between the groups was done by Chi square test with the significance $p < 0.05$.

Results: Most of the participants suggested that CBCT is more effective than OPG in detecting the pathologies of jaws and was statistically significant with the Chi-square test showing, $p = 0.02 < 0.05$. Majority response regarding common indication was tumour or cyst cases and was statistically significant with Chi-square test showing, $p = 0.03 < 0.05$. Almost all the participants considered CBCT as an advantage due to its shorter scanning time and was statistically not significant with Chi-square test showing, $p = 0.3 > 0.05$.

Conclusion: This study concludes that the students had an average level of knowledge about CBCT. Hence it is necessary to conduct qualification programs for dentists to strengthen their awareness toward cone-beam computed tomography.

Keywords: Knowledge; Awareness; CBCT; Imaging; Innovative technique; Survey

INTRODUCTION:

The advancement of Dental imaging reached heights with the development of 3-Dimensional (3D) imaging. This 3D imaging was not just applied in the diagnosis of maxillofacial pathology but also used for implant planning, complex endodontic treatments, treatment planning in orthodontics and many more. The introduction of Computed tomography in 1973 satisfied several of the above mentioned necessities, however, it had a few drawbacks due to its larger size and higher radiation dose owing to larger field of view (1). In the year 2000, Morita Co Ltd with Nihon University Business Centre Incubation Centre introduced the 3Dx multi-image CT (2). This was considered as the precursor of the Cone Beam Computed Tomography (CBCT) machine.

Cone beam CT is an imaging modality that has newly become advantageous for dentomaxillofacial imaging. When compared with conventional CT scanners, CBCT units cost effective and needs less space, possess rapid scanning time, limit the beam to the head and neck, reduce radiation doses and provide interactive display modes that enhance maxillofacial imaging and multiplanar reformation, making them more advisable for usage in dental practices (3). Imperfections include beam hardening, scatter from dental materials and low soft tissue contrast (4). General indications for CBCT in dentistry include analysing jaws for placement of dental implants, evaluation of TMJ for osseous degenerative variations, assessment of the proximity of mandibular third molar to the mandibular canal before extraction and also teeth and bone for signs of infection, cysts and tumours(5). CBCT systems work by focusing a cone shaped X ray beam on a two dimensional detector that rotates around the patient's head to provide consecutive 2D images. A cone beam algorithm is then applied, letting on the operator to extract planar and curved reconstructions of different thickness in any orientation and to bring about definite three dimensional images of bone and soft tissue surfaces to a very limited extent (6). The introduction of CBCT imaging has initiated a shift from 2D to a 3D approach in maxillofacial imaging. Also, there was a lack of application of this technology for efficient clinical practice. The major lacunae seem to be in understanding the possible areas where it could be utilised and where to be avoided.

In a study in a Turkish population only 54% of the respondents were aware of the applications of CBCT and a higher percentage of people were found among the academicians (7). In a Study among Swedish Dentists, there was an increased awareness of the radiation dosage of CBCT (8). In the Indian scenario, there weren't many studies focusing on the knowledge of CBCT. The dental students being the future dentists should be well familiarized with the modern digital

radiological techniques like CBCT. Our team has extensive knowledge and research experience that has translated into high quality publications (9–18),(19–22),(23–27),(28) This study aims to assess the knowledge of undergraduate dental students on use of CBCT in dentistry.

MATERIALS AND METHODS:

The present study was conducted among undergraduate dental students of Saveetha dental college. This questionnaire based cross sectional study which was approved by the institutional review board. This study Number of participants who took part in the survey was 100 which were distributed among three groups as group A consists of 1-3 years, group B consists of 4th year and group C comprises interns. The current study was undertaken with a convenient sampling method. The questionnaire was self structured and modified from the previous similar study questionnaire with demographic information and knowledge and awareness based close ended questions. The questionnaire validity checking was done by the faculty members of the institution. The questionnaire was circulated and data were collected using data collection software, Google forms. From the data obtained it was analysed and cleaned up to excel sheet. Then the data for each question is represented in the form of pie charts and bar charts. Analysis of data was carried out by SPSS by IBM, statistical software. Descriptive statistics was done to summarise demographic data and chi square test to analyse the survey data. The p value less than 0.05 was considered as statistically significant.

RESULTS:

The results obtained in the study are presented in the table and graphs.

Table 1: Shows the percentage of responses for the questionnaire circulated among 100 participants

Gender	Male	53
	Female	47
Education status	1-3 years	48
	4th year	29
	Interns	23
Have you heard of CBCT?	Yes	77
	No	23
Did you know that it is specially used for dentomaxillofacial?	Yes	64
	No	36
Do you feel CBCT is effective than OPG in detecting pathologies of the jaw?	Yes	76
	No	24
How did you obtain information regarding CBCT?	Through faculty teaching	26
	Seminars	26
	Internet	30
	Others	18
Why do you think CBCT as an advantage over medical CT?	Shorter scanning time	39
	Lower radiation dose	18

	Image processing is easier due to limited beam	15
	Less expensive	28
Have you received adequate knowledge from faculty regarding CBCT?	Yes	55
	No	45
How can knowledge on CBCT be increased among students?	Should be included in pre clinical lectures	36
	Should be included in clinical lectures	53
	Should be in PG lectures	11
What do you think is the most common indication for the usage of CBCT?	Implant application	22
	Tumour or cyst cases	35
	Examine morphology of root canal	28
	Orthodontic assessment	15
What could be the best usage of CBCT in endodontics according to you?	Detecting the number of canals	26
	Detecting the canal morphology	36
	Detecting the tooth vitality	27
	Detecting the vertical tooth fracture	11
Can CBCT be used in cancer staging ?	Yes	72
	No	28
To what extent do you think CBCT will be used in routine dental practice in the near future?	In all areas of dentistry	23
	For selected dental applications	33
	In general practitioners	30
	Not aware	14
Would you choose to use CBCT in your future	Yes	82

professional career?	No	18
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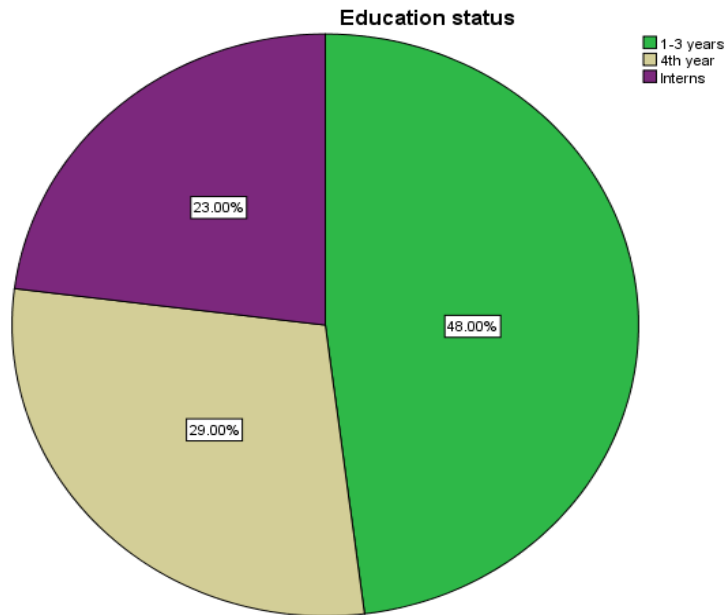


Figure 1: The pie chart represents the percentage distribution of year of study of participants in which 48% (green colour) were undergraduate students studying 1-3 years , 23% (violet colour) were interns and 29% (beige colour) were students of 4th year

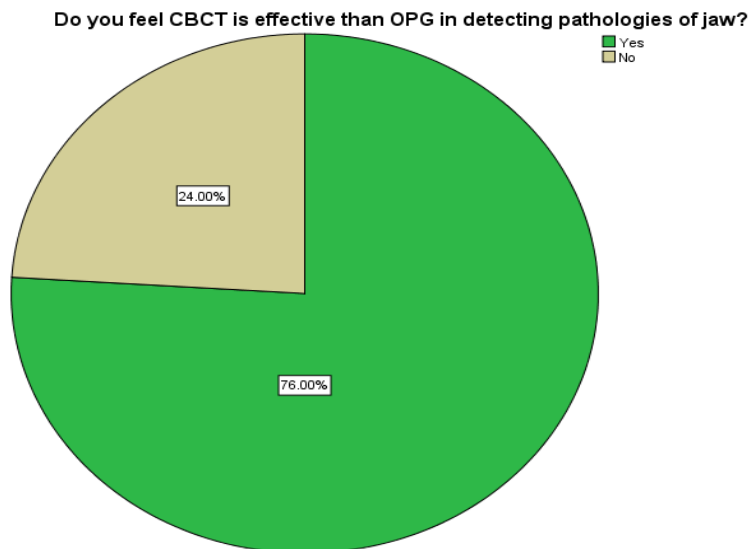


Figure 2: The pie chart represents the percentage distribution of participants responding about their thought on effectiveness of CBCT in detecting pathologies of jaw over OPG in which 76% (green colour) responded that CBCT is effective while 24% (beige colour) responded that OPG is more effective.

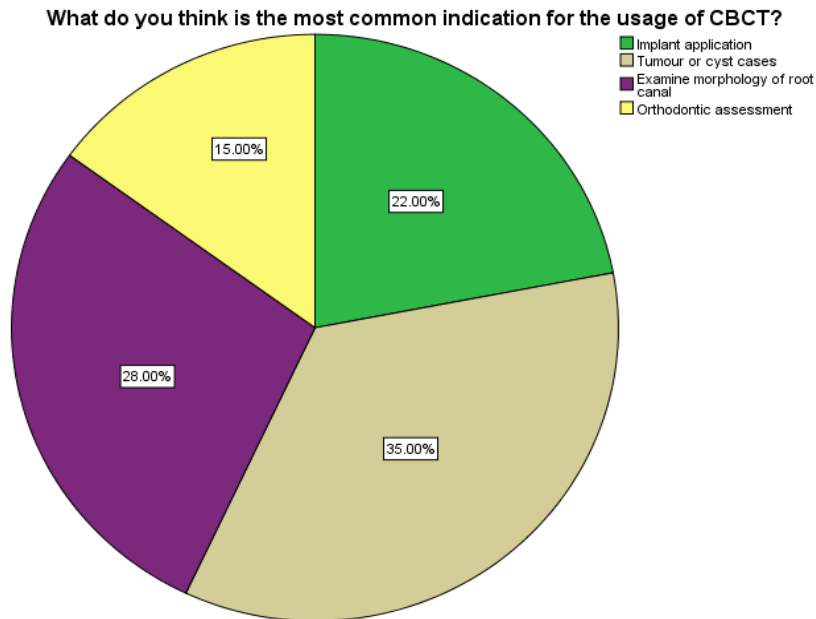


Figure 3: The pie chart represents the percentage distribution of participants responding on the common indication for the use of CBCT in which 22% (green colour) responded as implant application, 35% (beige colour) responded as tumour or cyst cases, 28% (violet colour) responded as examine morphology of root canal and 15% (yellow colour) responded as orthodontic assessment.

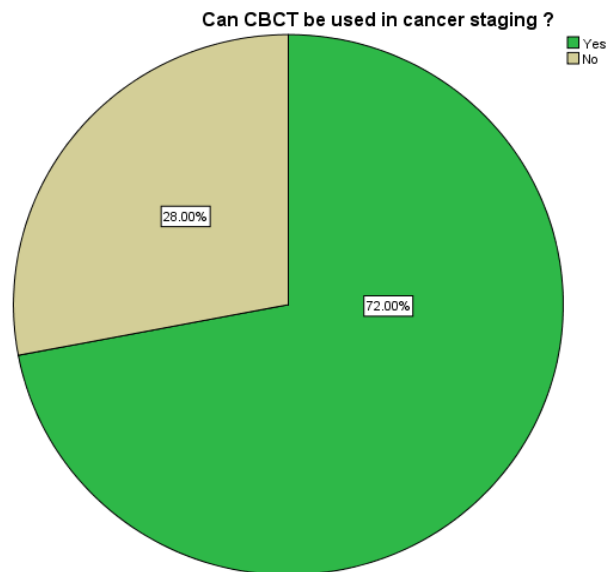


Figure 4: The pie chart represents the percentage distribution of participants in which 72% (green colour) responded that CBCT can be used in cancer staging while 28% (beige colour) responded that it cannot be used in cancer staging.

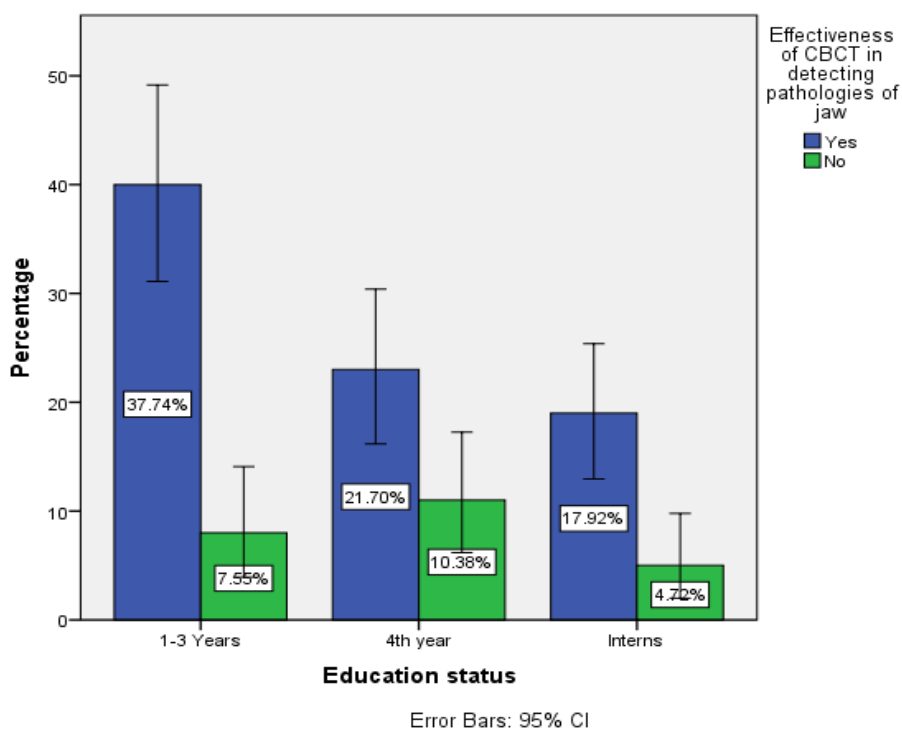


Figure 5: Bar graph showing the association between the year of study and the effectiveness of CBCT in detecting pathologies of the jaw. The X-axis represents the year of study and the Y-axis represents the number of participants. Blue denotes yes, green denotes no. Students of 1-3 years (40) suggested that CBCT is more effective than OPG in detecting the pathologies of jaws and was statistically significant. (Chi-square test showing, $p=0.02 < 0.05$ - Indicating statistically significant).

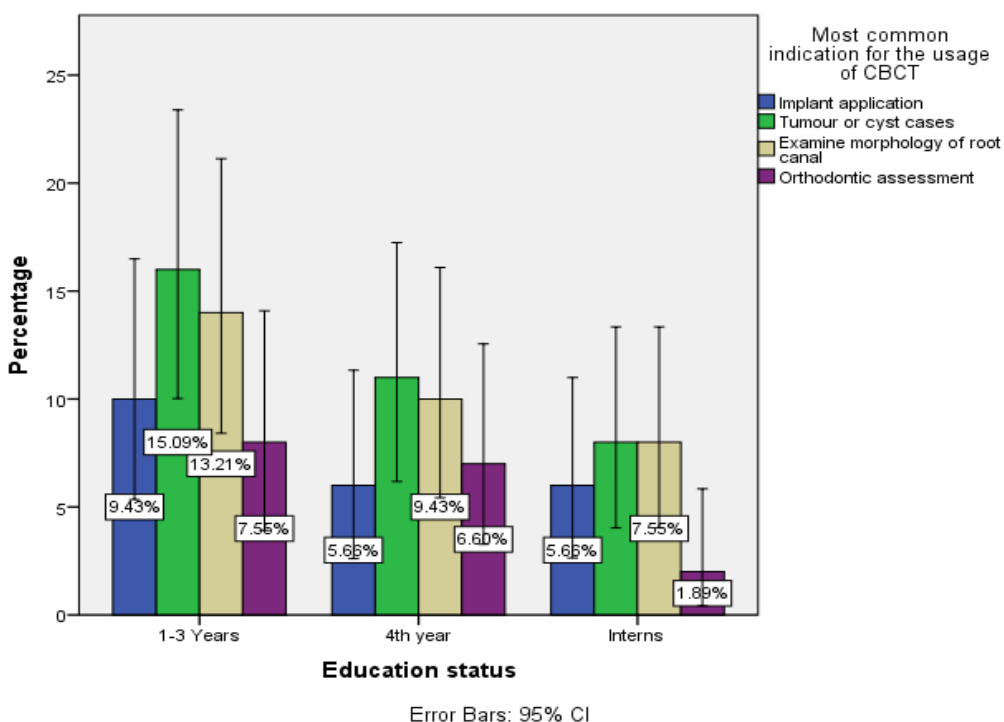


Figure 6: Bar graph showing the association between the year of study and the common indication for the usage of CBCT. The X-axis represents the year of study and the Y-axis represents the number of participants. Blue denotes implant application, green denotes tumour or cyst cases, beige denotes examine morphology of root canal and violet denotes orthodontic assessment. Students of 1-3 years (16) responded as tumour or cyst cases is the common indication than the students of other years and was statistically significant. (Chi-square test showing, $p=0.03 < 0.05$ - Indicating statistically significant).

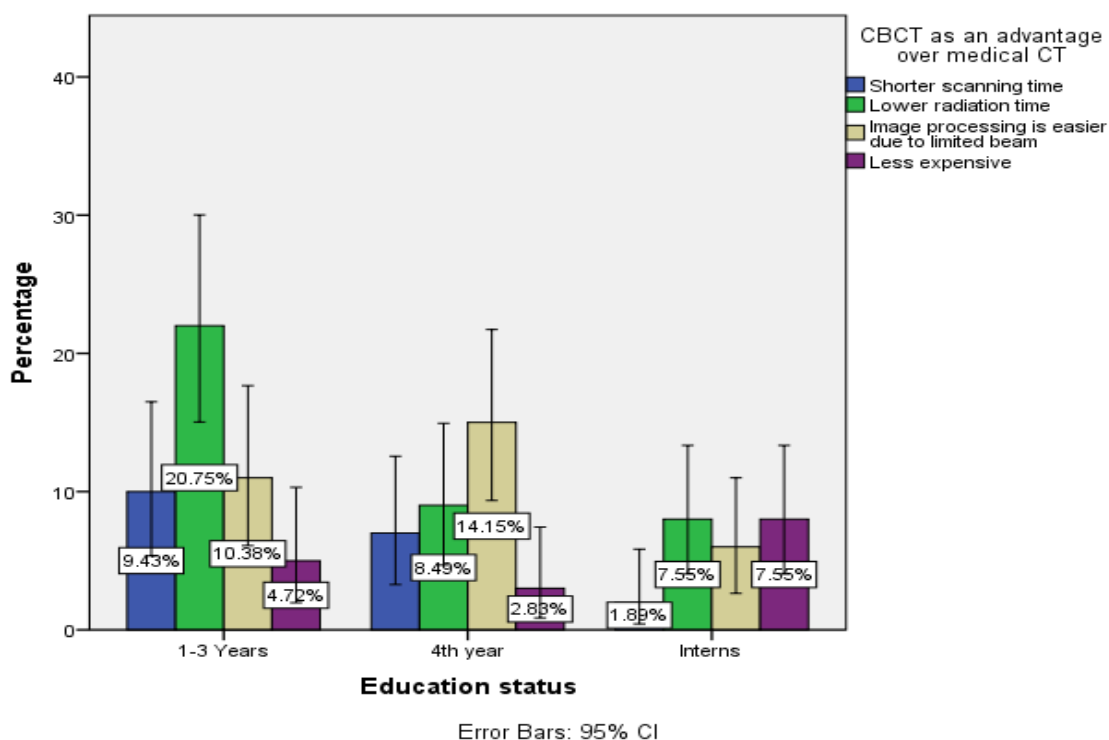


Figure 7: Bar graph showing the association between the year of study and the advantage of CBCT over medical CT. The X-axis represents the year of study and the Y-axis represents the number of participants. Blue denotes shorter scanning time, green denotes lower radiation dose, beige denotes image processing is easier due to limited beam and violet denotes less expensive. Students of 1-3 years (22) considered CBCT as an advantage due to its shorter scanning time and was statistically not significant. (Chi-square test showing, $p = 0.3 > 0.05$ - Indicating statistically not significant).

DISCUSSION:

The benefits of CBCT are being expanded daily to newer aspects of dentistry. In the initial days, it was mainly used for implant imaging but now the applications have expanded to all specialties of dentistry. However, one of the main limitations is the presence of numerous artifacts and limited soft-tissue resolution. Also, there is a lot of misconception regarding the dosage considerations for this imaging modality(29). This study attempted to assess the knowledge of the undergraduate students regarding the understanding of the applications of CBCT in Dental practice and their willingness to learn and constantly update their knowledge about CBCT.

Certain questions were framed to know the attitude of students regarding the importance and use of CBCT in their future career and to witness their attitude about the inclusion of CBCT in the undergraduate course. The circulated questionnaire and the percentage of responses were listed in **Table 1**. Our study depicted that the majority of students knew about digital imaging and about CBCT as an imaging modality in the oral and maxillofacial region. But there is a need of providing adequate knowledge about the principle used in CBCT based imaging as well as the reason for the choice of CBCT over CT in maxillofacial imaging. Majority population of this study consists of 1-3 years of undergraduates (48%) than final years and interns (**Figure1**).

This study revealed that the majority (77%) of the population were aware of the term Cone beam computed tomography. From the survey, we found that only (64%) of respondents were aware of its specific usage in dentomaxillofacial treatments. In a study by Lavanyaet *al.*, among the post-graduate students in India, only 68.2% of the respondents were partially aware of the usage of CBCT (30). As they have not grouped the postgraduate students according to the year of study, we consider that the awareness level was 51.4% among the interns seems better. A study by Ambeiteret *al.*, showed that 82% of the individuals were aware of the imaging modality in a study conducted in the European Population (31). This discordance can be due to the difference in the level of a professional career and also our study was carried out in undergraduates whereas their study was carried out in practicing postgraduates.

In our study, undergraduates suggested that CBCT is better over 2-D imaging in diagnosing the pathologies of jaws (76%) which indicates the usage of CBCT in imaging TMJ disorders (**Figure 2**). It was clear from our study that the majority of the undergraduates will be using CBCT in their future clinical practice (82%). The results are in accordance with the study carried out by Rosheneet.*al.*, (32) in interns and final year students.

In our study, the undergraduates were aware of the fact that 3D imaging is possible only by CBCT. The cumulative responses for common indication for use of CBCT was tumour or cyst cases (35%) followed by its use in examining the morphology of root canal (28%). This is in correlation with a similar study carried out by Bealset *al.* in the United States (33). The majority response of the interns for the primary indication of CBCT in dentistry was in implantology(**Figure 3**)

followed by its use in detection of cysts and tumors which is a contrast study (34). Thus the present study depicts the knowledge about the usage of this tool for advanced procedures.

In our study it was found that 72% of the respondents suggested that CBCT could be used for cancer staging (**Figure 4**). A standard image for cancer staging should provide an excellent soft tissue resolution but CBCT imaging has a limited soft tissue resolution (35). There were several studies that depicted the soft tissue resolution of CBCT which is highly compromised and cannot be used (36). The usage of CBCT in endodontics is the most debated question due to the presence of GuttaPercha and other restorative materials which severely restricts the usage of CBCT in imaging (37). In our study, a majority of participants (36%) suggested that CBCT could be used for examining the canal morphology. Whereas, prior studies state that the efficacy of CBCT for diagnosis is limited in missed canal cases(38).

In our study students of 1-3 years (40) suggested that CBCT is more effective than OPG in detecting the pathologies of jaws and was statistically significant (**Figure 5**). On assessing the indication for the usage of CBCT, students of 1-3 years (16) responded as tumour or cyst cases is the common indication than the students of other years which was statistically significant (**Figure 6**). Students of 1-3 years (22) considered CBCT as an advantage due to its shorter scanning time and was statistically not significant (**Figure 7**).

In our study, the majority of undergraduates suggested that there is a need for more frequent classes (53%) and lectures to be conducted for a better understanding of CBCT and the information about CBCT should be included in the pre clinical lectures (36%) of BDS courses. This result yet again reveals that there is a lack of knowledge among undergraduates about the necessity of CBCT.

Limitations and Future Prospects

The study limits the fact that it was conducted focusing only on undergraduates of a particular institution in which the participation of interns were less than the students of other years of study, making it an unicentric study. In future, the study can be conducted by analysing and comparing the knowledge level of participants from two different institutions with higher populations.

CONCLUSION:

This study establishes a good awareness on the knowledge and use of Cone beam computed tomography even in the preclinical students and their attitude towards the preference of CBCT in future careers is appreciable. But the working and need for the use are not well understood by the student population. Thus it is immensely necessary to increase the awareness of the usage of CBCT through including it in the curriculum and making it available for the students in the clinic.

ACKNOWLEDGEMENT:

The author would like to thank the study participants for their participation and kind cooperation and the faculty members of Saveetha dental college and hospitals for their support.

CONFLICT OF INTEREST:

The author declares that there was no conflict of interest in the present study.

SOURCE OF FUNDING: Saveetha Institute of Medical and Technical Sciences and Nanjil Oasis Trust, Nagercoil, Tamilnadu.

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